

# NEW ENGLAND FLOODS OF 1955



## PART 1 STORM DATA

ENGINEERING DIVISION WORKING COPY

RETAIN TO E



*Corps of Engineers, U.S. Army - Office of the Division Engineer  
New England Division - Boston, Mass.*

# **NEW ENGLAND FLOODS OF 1955**

## **PART 1**

## **STORM DATA**



*Corps of Engineers, U.S. Army - Office of the Division Engineer  
New England Division - Boston, Mass.*

**MARCH 1956**

## NEW ENGLAND FLOODS OF 1955

### PART I - STORM DATA

#### FOREWARD

This is Part I of a report in five parts on New England Floods of 1955.

The complete report presents the results of preliminary studies and investigations of the floods which occurred in New England as a result of the tropical storms of August and October 1955. The scope of data included in this report is limited to the material useful to the Corps of Engineers in studies pertaining to flood control investigations.

The complete report comprises five parts:

Part One - Storm Data.

Part Two - Flood Discharges.

Part Three - Flood Profiles.

Part Four - Flood Damages.

Part Five - Effect of Flood Control Projects.

## NEW ENGLAND FLOODS OF 1955

### PART I - STORM DATA

	<u>CONTENTS</u>	<u>Page</u>
GENERAL INTRODUCTION -		
Scope and Purpose.		I - 1
DESCRIPTIONS OF STORMS -		
General.		I - 1
"Hurricane Connie."		I - 2
"Hurricane Connie" rainfall.		I - 3
"Hurricane Diane."		I - 3
"Hurricane Diane" rainfall.		I - 4
"Hurricane Ione."		I - 6
Storm of October 14 - 17.		I - 6
COMPARISON OF 1955 STORMS WITH STORMS OF RECORD IN NEW ENGLAND		I - 7
COMPARISON OF 1955 STORMS WITH DESIGN STORM		I - 8
CONCLUSION		I - 9

NEW ENGLAND FLOODS OF 1955

PART I - STORM DATA

LIST OF PLATES

<u>TITLE</u>	<u>Plate No.</u>
Hurricane Paths	1
Isohyetal Map - Storm of 11-14 August 1955	2
" " - Storm of 17-20 August 1955 (large scale)	3
" " - " " " " " (small scale)	4
" " - Storms of 11-20 August 1955	5
" " - Storm of 14-17 October 1955	6
Mass Rainfall Curves - Storm of 11-14 August 1955	7
" " " - Storm of 17-20 August 1955	8
" " " - Storm of 14-17 October 1955	9
" " " - Storms of Record	10
Area Depth Curves - Storms in New England	11

## PART I - STORM DATA

### GENERAL INTRODUCTION

1. Scope and Purpose.- Part I describes the path and general pattern of the storms; tabulates the amount and distribution of precipitation; and compares the 1955 storms with storms of record and synthetic design storms. The storms affected a large area of the eastern seacoast extending from the Carolinas to New England. This report is limited to the effect of the storms on New England.

2. A complete analysis of the "Connie" and "Diane" storms is being made by the Office of the Chief of Engineers in collaboration with the Hydro-meteorological Section of the United States Weather Bureau. At the completion of that thorough analysis some parts of this preliminary report may be revised.

3. Acknowledgment is made to the personnel of the United States Weather Bureau for their cooperation in expeditiously providing part of the basic data for this preliminary analysis.

### DESCRIPTIONS OF THE STORMS

1. General.- Storms that visit the northeastern section of the United States generally approach from a westerly direction and are of moderate intensity. Occasionally, tropical storms from the south, as they proceed northward, either pass directly over or within striking distance of the New England states. These storms are usually attended by high winds and heavy precipitation. The great storms of November 1927, September 1938, August and September 1954, and August and October 1955 are in this category.

2. Unlike the hurricanes of 1938 and 1954, which were notable for their high winds, the hurricanes of 1955 were noteworthy for their high amounts of precipitation. Between 11-15 August "Hurricane Connie" brought substantial amounts of rainfall to southwestern New England, but very little runoff occurred as a result of dry antecedent conditions. However, when "Hurricane Diane" deposited record amounts of precipitation from 17-20 August on regions previously saturated by the rainfall of "Hurricane Connie," runoff of record proportions occurred. The resultant floods created major disaster areas in Massachusetts, Connecticut and Rhode Island. Heavy rainfall again plagued southern New England from the 14 to 17 October along the southeastern coast of Connecticut and in the vicinity of Westfield, Massachusetts. Again, damaging floods developed in many areas of New England.

3. "Hurricane Connie."- The first full hurricane of the 1955 season, "Hurricane Connie," was detected at 1<sup>2</sup>:30 a.m. 4 August about 1200 miles east of San Juan, Puerto Rico. (See Plate 1). It moved in a west-northwesterly direction until 5:00 a.m. 8 August, when it changed to a northerly course and headed toward the mainland of the United States. During the next few days, it hesitated off the coast of North Carolina and changed its course several times. The stalling of its forward movement was caused by the presence of two high pressure areas: one extending over the North Central states; the other hovering southeast of Newfoundland.

4. On 12 August at 10:00 a.m. "Hurricane Connie" moved inland over the coast of North Carolina when the high, which had been stationary over the North Central states, moved in an easterly direction. With the gradual shifting of this high, "Hurricane Connie" moved northward to Norfolk, Virginia where the

high pressure area in the northeast forced it to take a westerly course. During the next 24 hours "Hurricane Connie" passed to the southwest of New England on a northwesterly path across central Pennsylvania and western New York. The center of the storm filled as it passed over the high terrain of Pennsylvania, and it moved into the Great Lakes area as the blocking high to the northeast merged with the Newfoundland high.

5. "Hurricane Connie" rainfall.- "Hurricane Connie" brought rainfall to all of New England with the exception of the northern half of Maine. Precipitation was maintained at a rather uniform rate until the morning of 14 August when the skies began to clear. The southwestern portion of New England, being closest to the path of the storm, received the heaviest rainfall. An inspection of the isohyetal map (Plate 2) reveals an elongated ridge of rainfall extending along the Berkshires of Connecticut, Massachusetts and Vermont. The rainfall pattern was strongly affected by the orographic influences of the region.

6. Five to nine inches of rain occurred in western Connecticut and Massachusetts along the elevations bordering the Connecticut River valley. Although Mount Washington in northeastern New Hampshire was on the fringe of the storm, a six inch rainfall was recorded as a result of the high altitudes in that area. Southeastern New Hampshire and the eastern coast of New England received only two to three inches of rain. The 24 hour rainfall values for many of the stations in New England are tabulated in Table I - 1, and selected mass curves of precipitation are shown on Plate 7.

7. "Hurricane Diane."- On 11 August, when the rains of "Hurricane Connie" were beginning to fall in New England, another storm of hurricane proportions was detected about 450 miles northeast of San Juan, Puerto Rico. This storm,

known as "Hurricane Diane," moved in an erratic, but general northerly direction for two days before it took a fairly steady west-northwesterly course similar to that of "Hurricane Connie." (See Plate 1). During its forward movement "Hurricane Diane" became a full-fledged hurricane with maximum winds of 115 miles per hour near its center.

8. On 16 August when "Hurricane Diane" was approximately 200 miles southeast of the Carolinas, a stationary high was located east of Bermuda, and another high was centered over the Hudson Bay area. By the morning of 17 August, the high center in the Hudson Bay region had moved southeastward to the vicinity of Nova Scotia and "Hurricane Diane" had moved inland in the vicinity of Wilmington, North Carolina. On 18 August, a high pressure area developed in Iowa, and "Hurricane Diane" turned north-northeastward, crossing the high terrain of Virginia with reduced force. Near the latitude of Martinsburg, West Virginia, the storm turned sharply to the east as a result of changes in atmospheric conditions to the north and west. The zonal westerlies, accelerated in their path across southern Canada by changes in atmospheric conditions in the vicinity of Hudson Bay, brought about a general eastward movement of the pressure systems. As "Hurricane Diane" passed in a northeasterly direction south of Long Island on a course parallel to the southern New England coast, its center slowly deepened.

9. "Hurricane Diane" rainfall. - When "Hurricane Diane" changed its course and traveled south of New England, it became "recharged" with moisture which it literally dumped over southern New England. The elongated ridge of rainfall shown on the isohyetal maps, (Plates 3 & 4), is parallel to the path of the center of the storm. In southern New England, an excess of 12 inches fell on an area of approximately 3500 square miles, extending from the Berkshires in

western Massachusetts and Connecticut to the eastern coast of Massachusetts (average width of 25 miles). One to three inches of rainfall was recorded in parts of southern Vermont and New Hampshire.

10. Record amounts of rainfall were reported in many areas. Precipitation amounted to three to four inches along the coastal regions and increased progressively with 12" to 14" occurring in northern Connecticut and eight to ten inches in northern Rhode Island. The greatest intensities and depths occurred throughout central and southern Massachusetts which had three distinct centers of high rainfall. Westfield recorded 20"; West Brookfield 18"; and Walpole 16". Rainfall in northern Massachusetts amounted to three to four inches at the Vermont and New Hampshire borders. One inch of rain was recorded in the vicinity of Concord, New Hampshire. Rainfall values for "Hurricane Diane" are tabulated in Table I - 1.

11. This storm produced two periods of high rainfall. The rainfall began on 18 August at 6:00 a.m. with intermittent showers which continued until about 10:00 p.m. that evening. The first interval of high rainfall intensity occurred between 10:00 a.m. and 3:00 p.m. Some of the maximum hourly amounts recorded during that period were: 1.64" at Hartford, Connecticut; 1.55" at West Brimfield, Massachusetts; and 1.19" at Amherst, Massachusetts.

12. The second period of high rainfall intensity started at 2:00 a.m., 19 August and continued throughout the day, ending in Connecticut in the early evening hours and in Massachusetts at 9:00 p.m.. During this period, large amounts of rainfall were added to areas already over-saturated by the preceding rains.

13. The rate of rainfall during 19 August, was steady and sustained for most areas averaging 1.0" to 1.5" per hour. Mass curves of rainfall for selected locations are shown on Plate 8. The maximum recorded rate during this period was at Mendon, Massachusetts where two inches were measured between 6:00 and 7:00 a.m. and 3.20" during the following hour.

14. The isohyetal map (Plate 5) of the rainfall for the entire period of 11-20 August 1955 reflects the basic pattern of the "Hurricane Diane" augmented by "Hurricane Connie's" rainfall in the Berkshires. Similar to "Hurricane Diane," the major precipitation centers were Westfield 26", West Brookfield 20", and Walpole 18", all in Massachusetts.

15. "Hurricane Ione."- Less than one month after "Hurricane Diane," New England was alerted for "Hurricane Ione," advertised as the largest and most dangerous storm in years. On 19 September, "Hurricane Ione" struck the mainland at Morehead City, North Carolina with winds up to 120 miles per hour. After it passed inland, the storm lost much of its fury. South of Norfolk, Virginia it curved sharply and passed out to sea on an easterly course about 200 miles south of New England. (See Plate 1).

16. October 14-17 1955.-The 14-17 October storm was the result of a low pressure area which moved northward from the coast of Florida. A strong high pressure area in the vicinity of Labrador and the Gulf of St. Lawrence caused the low pressure area to stall off the New Jersey coast. The warm, moist tropical air moving up the eastern side of the low pressure area contacted the cool winds of the high pressure area over southern New England.

17. The heaviest rainfalls, as shown on Plate 6, occurred in western Massachusetts and Connecticut on the same areas affected by the rains of

"Hurricane Diane." Heavy precipitation amounts, totalling 12" to 14", occurred along the southwestern Connecticut coast; in the vicinity of Westfield, Massachusetts; and near the Massachusetts-Vermont state line. The Berkshires and Green Mountains apparently had an orographic influence on the high amounts of rainfall in those areas. A small secondary center developed just south of the New Hampshire state line with 11.96" of rainfall recorded at Ashburnham, Massachusetts. The daily rainfall values for the October storm are shown in Table I - 1.

18. The duration of the storm (indicated by selected mass curves, on Plate 9) was approximately 72 hours, extending from 6:00 a.m. on 14 October to 6:00 a.m. on 17 October. Heaviest rainfall occurred during the early morning hours on the 15 and 16 with nearly continuous moderate rain during the remainder of the period.

#### COMPARISON OF 1955 STORMS WITH STORMS OF RECORD IN NEW ENGLAND

19. Preliminary analyses of these storms, as related to New England, reveals that the heaviest precipitation in the storms of August and October 1955 occurred over the Berkshires in western New England. The heaviest precipitation in the storms of November 1927 and December 1948 was similarly located. This rainfall pattern is probably due to orographic influences and the prevailing paths of New England storms of tropical origin.

20. The relationships of the area-depth curves for "Hurricane Diane" and the October storms, and the storm of September 1938 (See Plate 11) indicate that "Hurricane Diane" had the highest rainfall amounts throughout most of the

area range. A more thorough analysis may show that the difference between the curves for "Hurricane Diane" and the storm of September 1938, is greater than indicated. This possibility is due to the fact that in this preliminary analysis of the August storm, no attempt has been made to include storm centers outside of New England, while the area-depth curve for the storm of September 1938 includes all of northeastern United States.

21. "Hurricane Diane", one of the biggest storms area-wise, may have been one of the most intense major storms in New England. The bulk of the rainfall fell within a 36 hour period, as compared to the four days of rainfall in September 1938. (See Plate 10). Comparisons of the slopes of the mass curves of rainfall on Plate 10 indicates that the rainfall recorded at Mendon, Massachusetts in the storm of 17-20 August, 1955 had the maximum intensities. The recorded intensities upon which this report is based, were undoubtedly exceeded in the ungaged areas and at some of the non-recording stations.

#### COMPARISON OF THE 1955 STORMS

#### WITH DESIGN STORMS

22. The storms of August and October 1955 exceeded the Standard Project Storm, for southern New England as developed from Civil Engineer Bulletin No. 52-8, in all areas. (See Plate 11). The Standard Project Storm rainfall proved to be approximately 55 per cent of the Maximum Possible Precipitation. (Hydrometeorological Report No. 28). The 1955 storms are much less than the Maximum Possible Storm, but they approach the mean depths of rainfall for the larger drainage areas.

23. Although the total rainfall in the Standard Project Storm was exceeded in magnitude by the August and October storms, when compared on the basis of intensity of rainfall, the Standard Project Storm was more critical. (See Plate 10). The maximum two hour value of precipitation for a Standard Project Storm for an area of 200 square miles in southern New England is 5.9 inches with a maximum one hour value of 4.7 inches. These compare with the recorded maximums of 5.2 inches and 3.0 inches for comparable period at Mendon, Massachusetts.

#### CONCLUSIONS

24. The storm associated with "Hurricane Diane" is the most severe storm, in respect to intensity of precipitation, magnitude and distribution, which has been recorded in New England. All precipitation criteria involved in the design of flood control works should be reviewed to consider this occurrence. The review will probably increase the magnitude and intensity of the rainfall used in synthetic design floods with a resulting increase in flood control effectiveness.



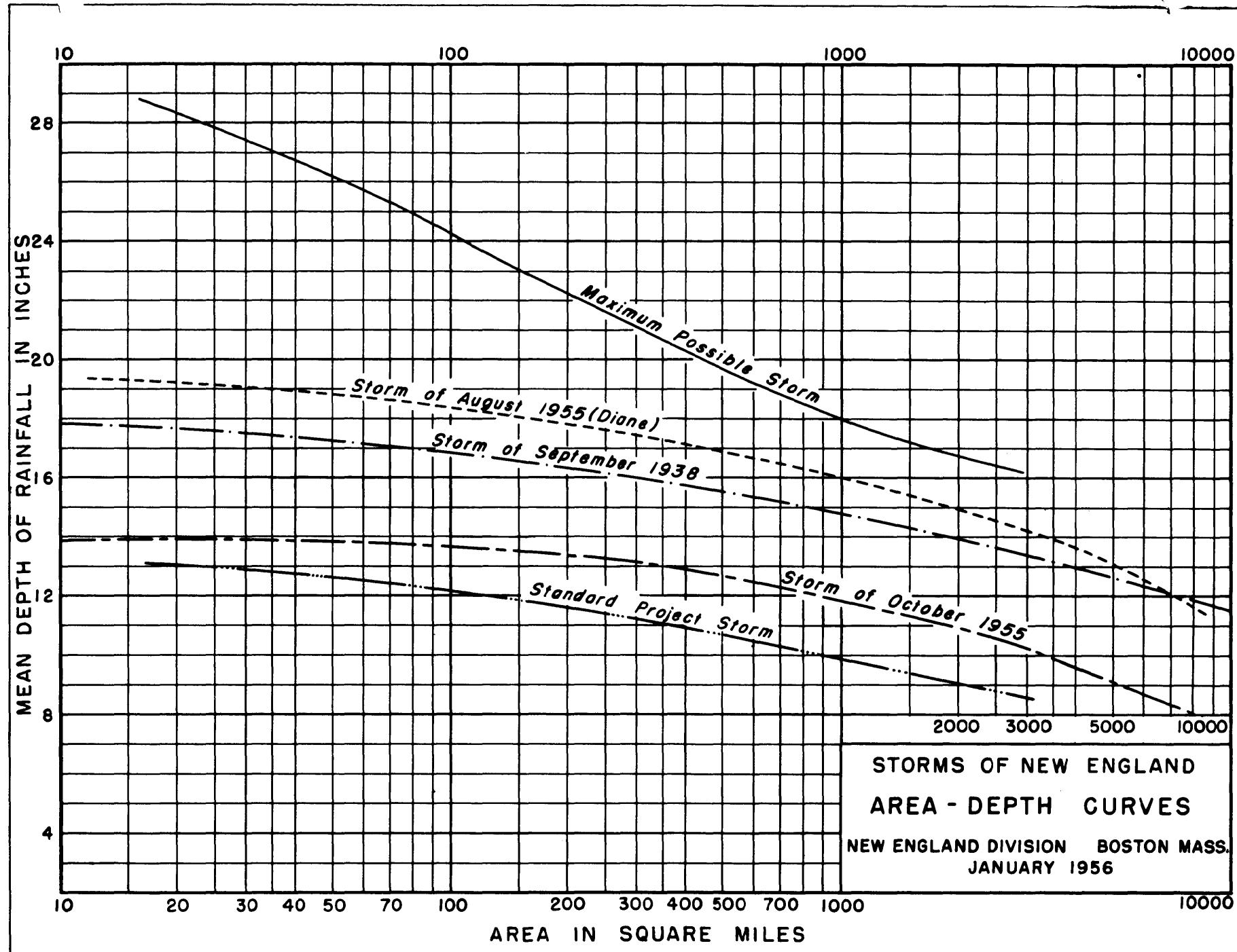








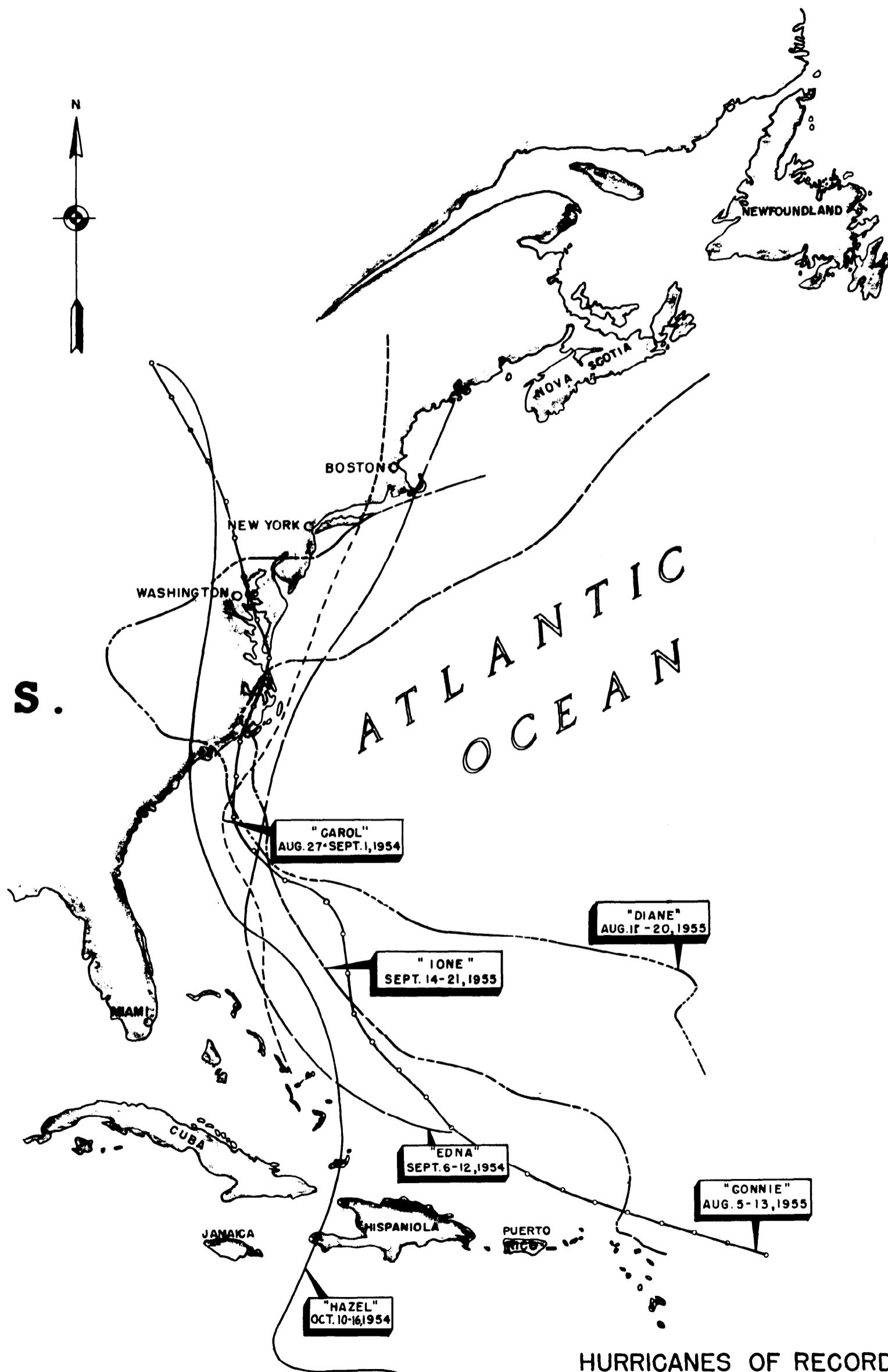




**U. S.**



# ATLANTIC OCEAN



## HURRICANES OF RECORD

1954 AND 1955

NEW ENGLAND DIVISION  
CORPS OF ENGINEERS U.S. ARMY  
BOSTON, MASS.

MARCH, 1956

PLATE NO. I

